DEVELOPMENT OF NANOSTRUCTURED GAS SENSING MATERIAL AS AN ETHYLENE GAS DETECTOR

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DEVELOPMENT OF NANOSTRUCTURED GAS SENSING MATERIAL AS AN ETHYLENE GAS DETECTOR

by

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LIST OF ABBREVIATIONS

Ar	Argon
Sn	Tin or Stannum
SnO_2	Tin oxide
$SnSO_4$	Tin (II) sulfate
Pd	Palladium
Pt	Platinum
$PdCl_2$	Palladium (II) chloride
NaOH	Sodium hydroxide
NWs	Nanowires
NSs	Nanostructures
SEM	Scanning electron microscopy
EDS	Energy dispersive spectroscopy
XRD	X-ray diffraction spectroscopy
UV-Vis	Ultra-violet visible spectroscopy
DOE	Design of Experiment
ANOVA	Analysis of variance
CV	Coefficient of variance
ppm	Part per million
ppb	Part per billion
VLS	Vapor-liquid-solid

LIST OF SYMBOLS

°C	Degree Celsius
≤	Less than or equal to
Ω	Ohm
ΔG	Gibbs free energy
%	Percentage
Å	Angstrom
λ	Wavelength of Cu-Kα line
β	Full width at half maximum
θ	Bragg angle
K	Shape factor
φ_m	Schottky barrier
μm	Micro-meter
nm	Nano-meter
s	Second

PENGHASILAN BAHAN PENGESAN GAS BERSKALA NANO SEBAGAI PENGESAN GAS ETILENA

ABSTRAK

Gas etilena adalah bahan penting dalam pemasaran produk pertanian segar kerana ia boleh digunakan secara komersial untuk hormon tanaman tiruan, mengawal dan memantau proses pemasakan buah-buahan klimaterik. Menyedari kepentingan alat pengesan gas etilena untuk proses pemasakan buah-buahan, banyak kajian telah dijalankan untuk mengkaji pengaruh gas etilena dalam proses pemasakan tanaman. Nanopartikel tin oxida (SnO_2) adalah bahan yang paling popular untuk mengesan gas etilena kerana ia adalah semikonduktor jenis n yang mempunyai jalur jurang yang luas, justeru itu, menyebabkan rintangan elektrik yang rendah dan pengkonduksian elektrik yang lebih baik untuk alat pengesan gas. Tambahan pula, suhu operasi yang rendah, kepekaan yang tinggi, reka bentuk sensor yang ringkas serta kos pembuatan yang rendah membuat SnO_2 pilihan terbaik untuk aplikasi pengesan gas. Dalam penyelidikan ini, pemendapan wap kimia (CVD) dan kaedah hidroterma telah digunakan untuk mensintesis nano-struktur SnO_2 (SnO_2 NSs). Sintesis, pencirian bahan dan sifat-sifat pengesan gas etilena telah dikaji dengan menggunakan nano SnO_2. Pertama sekali, nano-wayar (NWs) SnO_2 telah disintesis di atas substrat silikon dengan menggunakan kaedah CVD. Kesan daripada pemanipulasian pembolehubah CVD (seperti suhu sintesis, tempoh sintesis, kadar aliran gas argon dan gas oksigen) terhadap dimensi SnO_2 NWs telah disiasat dengan menggunakan analisa statistik iaitu Reka Bentuk Eksperimen (RBE) oleh perisian Design Expert 6.0.8. Mikroskop imbasan elektron (SEM), spektroskop serakan tenaga (EDS) dan spektroskop pembelauan sinar-X (XRD) telah mengesahkan fabrikasi SnO_2 NWs.